NOTES ON THE FRESH WATER SPONGES.

HENRY MILLS, Buffalo, N. Y.

In the study of the fresh water sponges, the student is brought into contact with many remarkable and interesting objects for investigation. The field of research is wide, and when entered with a true spirit of inquiry, becomes fascinating and yields pleasure not surpassed by the study of any branch of natural history. Sponges are generally destitute of external beauty, especially when plucked from the place where they grow. They assume a great variety of forms, which in some species depends largely upon their environment while growing. Those that grow under stones or logs, which are fastened to their moorings, or between the logs, as is sometimes the case, will have a different appearance from those which grow without interruption, and exposed to the light. But their form is unimportant as a means of classification, except in one or two species. The color in sponges is also of no account as to either species or variety. The points of interest can be learned only by studying their internal structure, through the use of the microscope. For the examination of the various spicula in the sponge, an instrument of moderate power, used with ordinary skill, will be sufficient for classification; but the successful study of the vital organs of these wonderful creatures requires the very best objectives, coupled with the highest grade of manipulative skill.

America, Europe and Asia have now contributed their wealth of specimens to this branch of learning, and much has been written by men eminent in scientific attainments; but, unfortunately, the most of their writings have been fragmentary, extending through many years or in publications not available for the use of the general scientific student. We are frequently met with the questions, What are the fresh water sponges? Where are they described, and what can I read to make myself acquainted with them? and we are unable to give the desired information. If the few hints in this paper should be of any service to such inquirers the writer will be well repaid.

The term spongiadæ is used to signify the whole of the sponges, marine and fresh water, which have been divided by naturalists into three orders, mostly in accordance with the chemical constituents of their respective skeletons. The first order, Calcarea, comprises those marine sponges whose skeleton is wholly or in part made up of calcareous spicula. The second order, Silicea, comprises those sponges whose skeleton is made up wholly or in part of siliceous spicula, and includes many marine, and all of the fresh water sponges. The spicula in this order resist the action of nitric acid. The third order, Keratosa, comprises the sponges of commerce, and all others the essential base of whose skeleton is keratose or horny fiber. These orders are all divided and subdivided, but it is unnecessary for us to pursue the divisions further.

The skeleton of the sponge is that part which gives it bulk and form, and without which the flesh, the sarcode, would collapse, and become a shapeless mass. The numerous pores and oscula would fail to perform their functions of letting in and passing out the fluids from which sustenance is obtained, unless the organism were supported by the skeleton. What bones are to the vertebrates this skeleton is to the sponge.

The first notice of the fresh water sponge is that by Leonard Plukenet in his "Almagestum Botanicum" in 1696. In 1745, Linnæus described two species, *Spongia fluviatilis* and *Spongia lacustris*, one supposed to be confined to rivers and the other to lakes or still water. This is now known to be a fallacy, both being found in running and in still water. Since Plukenet's notice, there have been published about forty principal papers, essays and monographs on the spongiadæ, noticing, of course, the fresh water species then known. In the early history of the subject all sponges were considered as vegetables, and it followed naturally that botanical terms should be applied to such minute parts as the microscopes of that time would enable the student to observe. Linnæus was acquainted with certain little globuli or seed-like bodies, which, now that we know the sponges to be animals, we call statoblasts, in keeping with the name of bodies of a similar character found abundant in the fresh water polyzoa. In both organisms they are really winter eggs, or resting spores, for the preservation of the

species during the vicissitudes of winter in fresh water. The botanists called these seed-like bodies *gemma* or *gemmulæ*, meaning a bud, or buds. These terms are still retained by some writers, much to the confusion of the subject. Of the publications above referred to, nearly half are in foreign languages, and the others are published in serials, or monographs, not easily obtained. Mr. Carter, by his invaluable contributions to this branch of natural history, has done more, perhaps, than any other person for its advancement; but the greater part of his articles are published in the Annals and Magazine of Natural History, extending through a period of about forty years, so that to obtain what he has written it is necessary to have access to these periodicals.

In 1842 Dr. Johnston published his "History of the British Sponges," which, according to Dr. Bowerbank, was gotten up with so much skill and sound judgment as greatly to facilitate the labors of succeeding students. He says it created an interest in this branch of study that had never before been excited to so great an extent. Johnston's work, although far in advance of anything hitherto published, was not faultless nor entirely free from the mystiness which so long hung over the subject of the sponges. Notwithstanding this, it ultimately proved to be the foundation of Bowerbank's really great work entitled "A Monograph of the British Spongiadæ," which was published in three volumes by the Ray Society in London in the years 1864, '66, '74, respectively. I believe this work was never in the market, but was distributed only to Societies of Natural History and public libraries. It is an invaluable help to the student, noticing every sponge, both marine and fresh water, known at the time of its publication, and will always remain a monument to the patient industry and perseverence of its author. In 1816 Lamarck introduced the term *spongilla* for the fresh water sponges, and the word became a sort of generic term for all the species up to the time of Carter's classification in 1881. Mr. Carter uses the term to designate his first genus, in which there are many species. The specific terms *fluviatilis* and *lacustris* are still retained, but with a different significance from that implied when they were first used. The term *fluviatilis* is now used to designate the simplest form of those sponges the walls of whose

statoblasts are charged with birotulate spicula. It is the simplest form of the genus *Meyenia*. A description of it is here given, taken mostly from Bowerbank:

Sponge massive, sessile; surface uneven, often lobular. Oscula simple, large, scattered. Pores conspicuous. Dermal membrane pellucid, aspiculous. Skeleton spicula acerate. Statoblasts mostly globular, spicula birotulate; short, rarely spinous, disposed in lines radiating from the center of the statoblast; rotulæ equal in size, deeply and irregularly dentate, diameter about equal to length of shaft of spiculum. Rotulæ sometimes not at right angles to shaft. Meyen, in 1839, first pointed out that the statoblast was partly composed of birotulate or amphidiscal spicula, and it was from this that Mr. Carter named his second genus *Meyenia*. Thus we have *Meyenia fluviatilis*, *Meyenia plumosa*, etc., etc.

The terms lacustris and lacustrian are sometimes used in a general sense to designate those sponges which have the spicula of the statoblast placed tangentially upon the outer surface of its walls, all of which are included in Carter's genies *Spongilla*. The specific use of the term *lacustris* applies to the branching sponges. In 1802, Charles Stewart, of Edinburgh, in his Elements of Natural History, describes *Spongia lacustris* as follows, *viz.*: Sponge creeping on other bodies, and taking their figure; brittle, with round obtuse branches; when young, flat, when old, putting forth branches. In autumn it contains little globuli like seeds, which explode when put in the flame of a candle. Subsequent writers were equally explicit in pointing out the branching of this species.

In 1884, Mr. Carter published an article in the *Annals and Magazine of Natural History*, on the Branched and Unbranched Forms of the Fresh Water Sponges, giving prominence to *Spongilla lacustris*, mentioning other forms of the same genus which are also branching. The following description of this sponge is principally from Bowerbank:

Spongilla lacustris, Johnston.

Ephidatia canaliculum, Fleming.

Holichondria lacustris, Fleming.

Sponge sessile, branching; branches long, round pointed, sometimes loose in texture; spicula more or less curved, fusiform, gradually sharp pointed, sometimes spiniferous. Dermal spicula thin,

curved, sometimes fusiform, spined throughout. Statoblast when fully developed globular (Carter) subglobose (Bowerbank).

Although these descriptions may be relied on as mainly correct, yet locality or other unknown causes may produce slight changes, so as to render it difficult to set up any exact standard of general application. We may always be sure, however, that there are no birotulates in any of the genus *Spongilla*, nor are there dermal spicula in *Meyenia fluviatilis*, although most of the genus *Meyenia* possess them in abundance. It is usually unsafe to depend on outward appearances, for it sometimes happens that sponges of the *Meyenia* type assume an arborescent form, due to becoming in a sense parasitical on stems of plants. Bowerbank speaks of this in Vol. II., p. 340. He says it is not at all unlikely that *Spongilla fluviatilis* may have been mistaken for *Spongilla lacustris* from this cause. I have in my possession a fine specimen of a variety of *Meyenia fluviatilis* found for me by a friend in Florida in 1883, encrusting as a parasite on the rootlets of the scrub palm. The filaments of the palm are so fine that the sponge might easily be mistaken for a branching sponge. The want of proper discrimination in the use of the terms applied to these sponges, perhaps in connection with the cause just mentioned, has been the cause of much confusion in the past. Using Mr. Carter as authority, we find that Johnston in the History of the British Sponges, puts Esper's representation of *Spongia lacustris* under his *Spongilla fluviatilis;* but in his diagnosis of *S. lacustris* never speaks of its branching, although that peculiarity had been recognized for many years, if not from the very beginning of sponge history. A similar mistake has occurred in our own country as lately as 1881. The impurity of the Boston water supply was such as to need investigation, and a committee of citizens with power to employ scientific help was appointed. In the course of the researches many fresh water sponges were found and were declared to be the cause of the cucumber taste then complained of in the water. Strangely enough, the report of these gentlemen contains an excellent drawing, illustrating the branching sponge *Spongilla lacustris* over the name *Spongilla fluviatilis*. A mere glance at either the sponge or the illustration is sufficient to show that a mistake has been made.

It may be stated in passing, that those best acquainted with the fresh water sponges believe that some other cause must have prevailed to give the cucumber taste to the water. While growing, the sponge would have no taste or smell, and when decayed and offensive, the taste or smell would be widely different from that of cucumber.

Spongilla lacustris is not only one of the oldest known but also one of the most widely distributed of the fresh water sponges, and if we include those of the genus *Spongilla* of which it is the type, there is no part of the three great divisions of the earth where it may not be found. America from Nova Scotia in the east to Vancouver's Island in the extreme west, and as far south as the river Amazon, has yielded interesting specimens of this type. Dr. Dybowski, of St. Petersburg, Russia, enumerates seventeen places, including Lake Baikal in Central Asia, where he has found *Spongilla lacustris*. From this last-named locality his brother brought him a branching sponge, *Spongilla lacustris*, charged with statoblasts. Also from the same place he brought another specimen new to the doctor, and which, as stated by Mr. Carter, he has described and illustrated as *Spongilla sibirica*.

This proves to be identical with our *Spongilla fragilis* found many years ago in the Schuylkill river by Dr. Leidy and subsequently by J. K. Lord, Esq., in the Cascade mountains in British Columbia, and named *Spongilla Lordii* by Bowerbank. Mr. Lord deposited his specimen in the British Museum, where it is still preserved for reference.

Much perplexity has arisen in the study of the fresh water sponges, from the absence of statoblasts in some most interesting specimens. As we have seen, the presence of these seed-like bodies was noticed in the very early history of the sponges, and they were soon recognized as the distinguishing feature between the fresh water sponges and some of the siliceous marine sponges which they otherwise closely resembled. It is well known that statoblasts do not mature in all species at the same season of the year. Specimens of *Spongilla fragilis* and *Meyenia fluviatilis* and many other species will abound in statoblasts as early as the middle of July, whereas specimens of *Spongilla lacustris* and others have been found

destitute of them as late as October, while in November and December, even from under the ice, in one instance on record, the same sponges have been found to contain them in large numbers.

It so happens that the localities where some of these specimens have been found, are so far from the centers of civilization that naturalists can only make occasional visits; in most cases these would be likely not to occur at the season when the sponge is quite mature. A large quantity of *Spongilla lacustris* collected in northern Illinois in the past season by myself, is almost destitute of statoblasts. Could the sponges have been collected in November instead of September there is reason to believe they would have been plentiful. The remarkable branching sponge mentioned by Bowerbank as *Spongilla corralioides*, and by Carter as *Uruguaya corralioides*, was found in the river Uruguay twenty-five years ago, 200 or 300 miles from salt water, and, as far as present observation and research can discover, no trace of statoblast or any other reproductive organs have been found. Also, a geuus found in central Asia, and described by Dr. Dybowski as Lubomizskia, contains several species, some of them branching, said to be without statoblasts. In the examination of the gatherings of two seasons of a sponge found in Florida, I had been unable to find statoblasts or other satisfactory evidence of reproductive process, but a week ago in looking over a slide mounted nearly two years since, I found a few of the birotulate spicula, indicating unmistakably that statoblasts do appear, although later in the season than my gatherings.

But still there is another aspect to this whole question. It may be an unwarrantable assumption that the fresh water sponges are dependent in any great degree on the statoblasts as a means of reproduction. That they do propogate by these seed-like bodies admits of no doubt, but nature is prolific in means to adapt itself to its surroundings; hence we find, upon the authority of those who have studied the living marine forms, as well as those of the fresh water, that there are other modes of reproduction. When one mode fails or is needless, another is brought into requisition. Ehrenberg, in the description of a sponge of his discovery, says: "The sexual as well as the statoblast means may take place for the reproduction of Spongilla," meaning the fresh water sponge. Also, Bowerbank

enumerates five processes by which the Spongidæ may be reproduced.

It may be, therefore, that, in localities where, from depth of water or other cause, the temperature is preserved with some degree of uniformity, sponges live through the year with little or no cessation of growth, and, therefore, without the necessity of the winter egg. This idea appears reasonable, and is entertained by many qualified to judge.

In the foregoing notes an attempt has been made to describe the two oldest and most widely distributed of the fresh water sponges, using the terminalogy and classification of Mr. Carter, made in 1881; his classification being the only one based on principles worth consideration. As each of these sponges is in a sense a representative of the two groups into which the fresh water sponges may be divided, it is hoped that a thorough knowledge of them will greatly assist the student and prepare him for the successful study of most of the known species. A knowledge of these sponges will at least assist him in the economy of his time.

Had the terms *fluviatilis* and *lacustris* been thrown out of sponge literature a century ago, or as soon as they were found to have no specific value, we can see that much confusion would have been saved in the past. What may come in the future through their retention is incalculable. Their obvious etymological meaning and their technical significance as now used have no connection whatever.